Development Of The Health Laboratory Information System To Support The Evaluation Of The Laboratory Services

(Case Study at The Health Laboratory in District of Purbalingga)

Yeni Mahwati
Sekolah Tinggi Ilmu Kesehatan Dharma Husada
Bandung, Indonesia
e-mail: riza_moms@yahoo.co.id

Cahya Tri Purnami
Public Health Faculty
Diponegoro University
Semarang, Indonesia

***Abstract*— Evaluation of health services is a regular and systematic process to compare between an achieved result and standard criteria. A laboratory is one of health services which it must continually evaluate and integrate a technology within its services to improve quality for achieving customers' satisfaction. The objective of this research was to result health laboratory information system which could be used to support the evaluation of the laboratory services at the Health Laboratory of Purbalingga Distric. Development of the system was based on the FAST "Framework for the Application of Systems Techniques" methodology. Design of this research was pre experimental one group pretest and posttest. Number of subject was seven respondents. The research variables were accessibility, accurateness, completeness, and clarity of information. The result of this research showed that the new system could overcome the problems of data accessibility, accurateness, completeness, and clarity of information to support the evaluation of the laboratory services. The considered average on the new system (3.92) was higher than the considered average on the old system (1.55). Based on the statistical analysis, it showed that there was any differences of information quality between the old and the new system (p value = 0.0001). The hospital management should maintain the new system, recruit a specific officer, and evaluate the system for sustaining and repairing it.**

Keywords; information system; health laboratory; evaluation of the laboratory services

I. INTRODUCTION

Today the laboratory is one of the most dynamic environments in health care. Medical community put pressure on laboratories to extend the range of services due to competition, especially the private sector is increasingly sharply in the current era of globalization. In the face of such competition, the laboratory must continually evaluate and integrate technologies that are rapidly changing into their services [1,2]. Evaluation of services is one important step in the management and the basic requirements for controlling and maintaining the quality of service. Evaluation of health services is a process that is orderly and systematic in comparing the results achieved with benchmarks or criteria established, followed by conclusions. Through the evaluation, the laboratory can perform quality repairs that could ultimately achieve customers' satisfaction [3]. Evaluation of services can be done by looking at the results of operations (performance evaluation) and usability (efficiency) health services [4]. To assess the performance and service quality in the laboratory can be measured by looking at the results of laboratory tests such as the number of service categories based on the examination, the average examination per day, percentage of routine examination, the ratio of the examination without abnormalities, and laboratory revenue performance per year [5]. The Health Laboratory of Purbalingga Distric has implemented a laboratory information system manually. Although computers are available but their utilization is not optimal. In practice there are several problems with the existing information systems: (1) recording identity of patient and sample repeatedly, (2) the process of collection, data processing and report generation are still done manually allowing calculation of error, (3) output the report information about costs is not available quickly, reports the results of clinical examination is still written by hand writing on the format that has been provided, the summary of the results of laboratory examination and history, financial statements and laboratory statistical reports, and a report on the external customer list is not yet available. Of some constraints on the system of the above information, it can be concluded some problems regarding the quality of information produced, namely: Accessibility, Accurateness, Completeness, and Clarity. This will result in the information required by management in conducting the evaluation service. Therefore, to support the service activities and evaluation services needed computer-based laboratory information system that can support decision making. Laboratory service evaluation activities should be done as a continuous quality improvement efforts that will satisfy the customer.

II. MATERIAL AND METHODS

The research using pre experimental (one group pre and post test) design, that measures only one group of objects before and after the intervention [6]. The research variables were accessibility, accuracy, clarity, and completeness of information. The object of research is a health laboratory information system. The study subjects were observed are those associated with the information system: the Head of Laboratory, the Head of Administration, registration officer, financial officer, technical officer and data

processing officer. Development of The Health Laboratory Information System carried out by using the method of Framework for the Application of System Techniques (FAST). This method is used because it underlies all methods of system development: (1) involving the users of the system, (2) using a problem solving approach, (3) forming a phase of activity, (4) documented throughout the development, establish standards, processes and managing projects, designing systems that conform to the changes and technology developments. The flow research using FAST stage which consists of: (1) preeliminary investigation (2) problem analysis, (3) requirement analysis, (4) decision analysis, (5) design, (6) building new system, (7) implementation [7]. The results of observations and interviews conducted by the method of content analysis, descriptive analysis using the weighted average and analytic analysis using Sign Test.

III. RESULTS

A. *Preeliminary Investigation*

The health laboratory information system before the develompent of new system have weakness, (1) recording of patient identity/sample repeatedly, (2) the process of recording/collection, data processing and report generation are still manualy enable calulation errors, (3) the cost information is not available quickly, reports the results of clinical examination is still written by hand writing on the format that has been provided, the summary of the results of laboratory examination and history are not yet available, financial and statistical reports incomplete, report on the list of external customers are not yet available. So it can be conclude some information problem are: *accecibility*, *accuracy*, *completeness*, and *clarity* of information.

B. *Problem Analyis*

At this stage of problem analysis, the activities carried out are studying and analyzing systems that are running currently, with the aim to discover the weaknesses of the system that has been running for the proposed recommendation [8]. From the results of the identification of the cause of the problem, the next decision point identified the cause of the problem are: (1) storage and statements have not been using a DBMS for it is still difficult to obtain data and information easily (accessibility), (2) data processing, especially the calculation process is still manual so that the risk of errors (accuracy), (3) the information produced for the Head of Laboratory incomplete to support the evaluation of services in laboratory (completeness), (4) a report is presented in tabular and narrative can not be used to analyze the trend (clarity).

C. *Requirement (Needs) Analysis*

In the requirement analysis phase aims to identify the types of data, information, processes and interfaces required by the user with the ultimate goal is to increase system [7]. In this study observations and interviews conducted step towards the users of the system are the Head of Laboratory, the Head of Administration, the registration/payment officer, the financial officer, technical officer so it can be reflected the needs or systems requirements of users at various levels of management as follows: (1) can produce information about fees charged to patients or service users based on the type of examination quickly, (2) can present the results of the examination based on the examination report that has been done and can automatically presents the normal values, a summary report of laboratory tests results and history, financial reports, statistical reports laboratory, reagent usage reports and reports on service users, (3) can improve data management in terms of presentation of data quickly accessible, accurate, complete and clear to support the evaluation of health laboratory service.

D. *Decision Analysis*

At this stage, there are several steps that passed: identifying new system alternatives, analyze the feasibility of a new system alternatives and the final step is the selection of an alternative system that will develop [8]. In this study selected the Microsoft (MS) Windows with consideration of the users can using the operating system. Windows also has several advantages including: (1) user friendly compared to other operating systems, (2) installing the software was easy compared with the installation on other operating systems, (3) many Windows-based software, (4) drivers support for more [9]. Development of health laboratory information system using PHP tools and the MySQL database. PHP is one of the development tools to make an application. Applications created using PHP more devoted to the database, easily understood and visually-based, and open source. While MySQL is one type of database server that can act as an open source client with the ability to run both OS (Operating System) and the Platform Windows [10].

E. *Design*

At the design stage of the model systems, processes and data flows that occur in health laboratory information system is illustrated in the form of logical Data Flow Diagrams (DFD) using the methodology and the symbols are arranged by Gane-Sarson [11]. The development system case tools used to describe the processes in health laboratory information system is Microsoft Visio version 11. The new health laboratory information system context diagram can be seen in Figure 1.

The difference between systems that have been running during the research done by the system to be developed, namely: (1) The data inputted by the technical officer obtain additional data that the examiner, (2) Information received

from the Head of Laboratory get additional system developed in the form: summary of the results and history of laboratory examination and laboratory statistical reports, financial statements, users of the service, (3) Addition of a new entity that is the Head of Administration who received the same output with the output received by the Head of Laboratory. List of events on health laboratory information system to support to support the evaluation of health laboratory service are: (1) Data collection is the recording of the master data such as patient data, sample data, data type checking, data reagents, (2) The transaction is the recording of data discount the cost of inspection, examination results data, user data and stock reagents are divided into two types of service that is of service in the registration / payment charges and in the technical implementation, (3) The report includes the results of the examination report, the summary of the results of the examination, the financial statements, statistical reports laboratory, reagent usage reports and user reports of laboratory services.

Table 1 Output Draft of Health Laboratory Information System

No	*Output name*	*Output format*	*Output media*	*Output tools*	*Distribution*
1	Bills information	Table	Paper	Printer	- Patients - Agencies - Registration officer
2	Result report	Table	Paper	Printer	- Patients - Agencies - Registration officer
3	Summary of results and history of laboratory test	Table	Paper	Printer	- The Head of Laboratory - The Head of Administration
4	Financial reports	Table and graph	Paper	Printer	- The Head of Laboratory - The Head of Administration - Health distric
5	Reports the laboratory statistics	Table and graph	Paper	Printer	- The Head of Laboratory - The Head of Administration
6	Reports the use of reagents	Table	Paper	Printer	- The Head of Laboratory - The Head of Administration - Registration officer - Health distric
7	Report the service user's	Table	Paper	Printer	- The Head of Laboratory - The Head of Administration

The output is the product of information systems that can be seen, which consists of the display on hard media, such as paper or results in the media software, such as on-screen display video [8]. Based on observations and interviews with user needs then obtained the following output:

The design aims to provide input forms of input in the document and on the screen to the information system design [12]. Input design of health laboratory information system to be developed can be seen in table 2.

Table 2 Input Draft Health Laboratory Information System

No	*Input Name*	*Input format*	*Input tools*	*Input officer*
1	Patient data	Form	Keyboard	Registration officer
2	Sample data	Form	Keyboard	Registration officer
3	Village data	Form	Keyboard	Registration officer
4	District data	Form	Keyboard	Registration officer
5	Data examiner	Form	Keyboard	Technical officer
6	Data type of examination	Form	Keyboard	Registration officer
7	Data reagents	Form	Keyboard	Technical officer
8	Data examination results	Form	Keyboard	Technical officer

Database design aims to organize the data so that it will obtain the ease, accuracy and speed of retrieval. To design a data base of one of the methods is to use the Entity Relationship model using the Entity Relationship Diagram (ERD) [13]. The database of health laboratory information system being developed are: patients, samples, examiner, type of examination, village, district, reagents, reagents transaction , bills, medical records laboratories.

Designing the dialogue interface is the design of a dialogue between the user interface system with computer [7]. Interfaces in the form of data input, report and admin area guide that includes: transaction interface (clinical registration, registration of non-clinical, laboratory, reagents transactions), report interface (clinical examination results, examination results of non-clinical, reagents reports, financial reports, statistical reports, customer lists), instruction interface, and admin area interface.

F. Building New System

Stage of building a new system aims to build and test the system as needed and design specifications, implements the interface between new and existing systems [8]. At this stage, aided by a programmer.

G. Implementation

The next stage of system development is the implementation, which putting the system to be ready to operate [8]. In accordance with the design of trials of one group pretest-posttest design that is on there is no comparison group (controls), but has already made the first observation (pretest) for one week, then made a second observation (posttest) for one week. Training is done by providing an explanation and how to operate the system by giving the user manual response to the operation and implementation of new systems. System test phase aims to test whether the system is made free from error [9]. Tests

performed included testing the accessibility, quality, accuracy, completeness and clarity of information.

The test results showed that health laboratory information system has been designed to overcome the problems associated with information system quality, namely: accessibility, accuracy, completeness and clarity of information. The resulting report can be used to support the evaluation of laboratory services. The quality of information to support the evaluation of new system is better than the old system which can be viewed through the summary and the weighted average of test results using the Sign Test. The summary of results of measurement information quality before and after development new system shows shows an increase in the overall weighted average prior to the development of (1.55) to 3.92 after development.

Tabel 4 Result of analysis with the sign test

The Variabel	p
Analysis of differences in the performance evaluation of the old system and new system	0.0001

Sign test shows the probability of 0.0001 ($p<0.05$) which means that there are significant differences between the old system with a new system.

IV. CONCLUTION AND RECOMENDATION

The results of this research shows that information system have been able to overcome the problems associated with information system quality: accessibility, accuracy, completeness, and clarity of information. The quality of new laboratory information system are better than the old system which can be viewed through the summary of the overall weighted average results which showed an increase from 1.55 to 3.92 as well as proven by the results of Sign Test which shows the probability of 0.0001 ($p<0.05$). Health laboratory information system can be developed into a network-based information system LAN (Local Area Network) and web-based. So if they want to use this system, only need to provide facilities / means of support. Health laboratory information system still needs to be further developed to be used for: (1) analyze the reagent supply to prevent excess or shortage of supply of reagents, (2) displaying report nonclinical results mainly bacteriologia l examination of water in accordance with a standardized format, (3) keep in maintenance and procurement efforts are specialized personnel on duty to handle systems that have been developed in order to keep the system running well, (4) Need to do an evaluation of information systems have been developed for the sustainability and improvement of the system.

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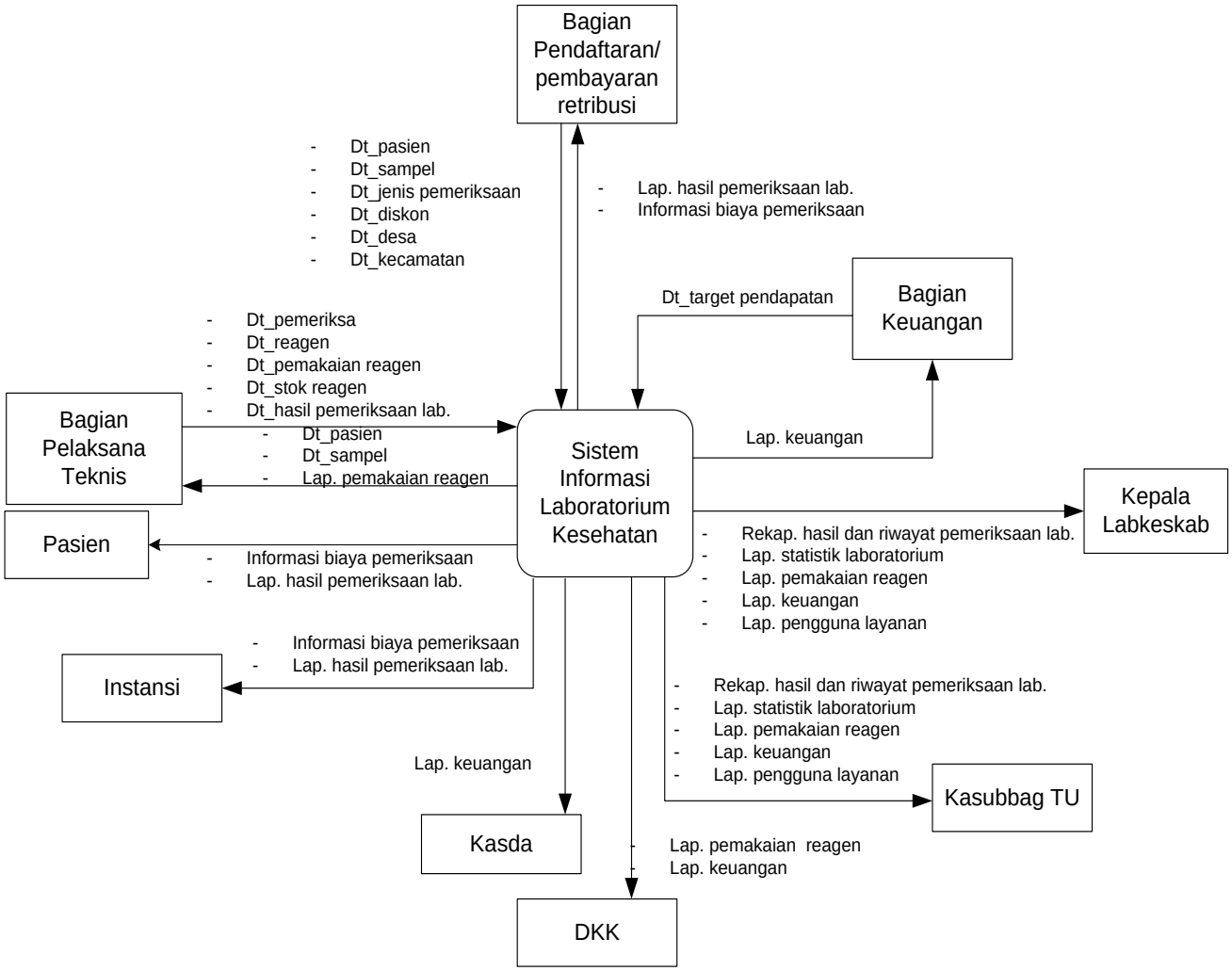

Figure 1 Context Diagram Health Laboratory Information System (New System)